drated material under pressure in suitably shaped molds. Pressure, duration of molding, and temperature during molding may be varied depending upon the composition of the respective dehydrated material and/or its water content and can readily be determined by preliminary experiments for each type of starting material and for each shape and use of the molded bodies. The molding pressure may be between about 20 kg./sq. cm. and about 50 kg./sq. cm. and the molding temperature between 20° C. and 70° C. The resulting transparent and clear molded articles may be shaped in such a manner that they possess the desired inner and outer curvatures, i.e., the desired refractive index. It is readily possible, for instance, to produce replacement lenses or contact lenses with the refractive index of the natural lens, namely with a refractive index of 1.38, i.e., the refractive index at the periphery of the lens, or with a refractive index of 1.41, i.e., the refractive index of the lens nucleus. However, it is also possible to produce transparent molded optical bodies with a refractive index of 1.47 to 1.48 from the protein of the eye lens, i.e., very near to the refractive index of the synthetic plastic material used heretofore for such aids to vision, namely the polymerized methyl methacrylate sold under the tradename "Plexiglas." Thus it is possible to produce molded optical bodies of different curvatures, refractive power, and other optical data and to keep such bodies, lenses, contact lenses, and the like in stock and on hand.

(c) Preparation of articles aiding vision from the lens shell or peripheral part of the eye lens

(1) When using as starting material the protein of the outer shell or layer of the eye lens, i.e., the more liquid peripheral lens substance, this material is first dissolved in aqueous solutions of suitable dissolving agents such as acids, for instance, pyruvic acid, lactic acid, tartaric acid, citric acid, and the like hydroxy carboxylic acids, or alkaline agents, for instance, lithium hydroxide, sodium hydroxide, potassium hydroxide, ammonia, urea, thiourea, and their alkyl derivatives, and the like, or salts, for instance, lithium thiocyanate and others. Said dissolving agents may also be used in mixture with each other. Of cource, only dissolving agents and solvents can be used which do not cause any substantial denaturation of the protein and which do not in any way affect and/or attack the lens shell material. Initially these dissolving agents cause swelling of the eye protein. The swollen protein is then dispersed mechanically and dissolved to form a colloidal solution or paste. Preferably such mechanical dispersion and dissolution is carried out at room temperature. The most suitable concentrations of said dissolving agents and solvents can readily be determined by simple preliminary tests. Preferably 0.01 N to 2.0 N solutions are used. Urea may be employed in higher concentrations up to 6.0 N solutions. Rather concentrated solutions or colloidal sols of the peripheral lens substance which are clear and substantially free of degraded, denaturated protein, are obtained in this manner.

Of course, it is also possible to produce clear solutions or pastes of the nuclear lens substance or of the entire lens protein and to use such solutions and/or pastes in the following gel-forming steps.

(2) For reconstructing the lens material, the resulting colloidal solution containing the proteins of the outer shell or peripheral layer of the eye lens or the proteins of the nucleus of the eye lens or both types of proteins, is converted into a gel by allowing gel-forming ions to diffuse thereinto. Thereby, first orientation of the gelled filamentary protein takes place which, therefater, solidifies to a transparent, clear gel. Of course, care must be taken that only such diffusing ions are allowed to act on the solution which do not cause denaturation of the protein. Elasticity and strength characteristics of the resulting gel may be increased and improved by allowing the compensating ions or "gegenions" to diffuse periodically in so-called ion waves. Preferred compensating ions are ions of polyvalent metals, especially of calcium, cadmium, zinc, and copper as well as hydrogen ions. The metal ions are supplied by using metal salt solutions, especially metal nitrate solutions. Once the final structure of the gel is formed, the metal ions can be exchanged by hydrogen ions without any substantial change in the structure and orientation of the gel. Only very small ion concentrations, comparable to those of trace elements, are necessary for gel formation.

Diffusion of the ions into the solutions preferably takes place through suitable membranes which are permeable to the ions and which are provided in the shape of the desired molded body. The solutions are placed into such membranes which have, for instance, the shape of the eye lens, and the ions are allowed to diffuse from the outside into the solution, thereby solidifying the same to the desired shaped gel consisting of oriented filamentary molecules as present in the native eye lens.

Gel formation may also be effected by dialysis and electrodialysis, preferably in a three-cell electrodialyzer according to Thiele and Lange "Kolloid-Zeitschrift," vol. 169, p. 86 (1960), and/or by changing the pH-value of the sol.

The membranes used for ion diffusion or in the electrodialyzer are composed of any substantially inert, ion-permeable membrane material, for instance, of cellulose esters, such as cellulose acetate, cellulose nitrate, of alginates, or the like which can readily be shaped to the desired mold. It is, of course, also possible to produce a body of the eye protein gel in the form of a block or a plate and to cut therefrom by mechanical means the desired shaped bodies such as lenses for replacing the native eye lenses, as contact lenses, and the like.

(3) Thereafter the resulting shaped gels are gradually dehydrated and preferably irreversibly cross-linked. By such a treatment they are rendered resistant to aqueous solutions and liquids and to the action of the atmosphere. Such cross-linking and stabilizing may be effected by using water-soluble cross-linking agents such as short-chain aldehydes, preferably formaldehyde, or α,ω-dialdehydes, such as glutar dialdehyde, 1-hydroxy adepic dialdehyde ethers. The aldehydes and dialdehydes are employed together with amines, preferably with polyvalent amines such as triethylene diamine and others. It is, of course, also possible to add, during gel formation, agents which subsequently can be converted into cross-linking agents, for instance, hexamethylene tetramine and to initiate cross-linking after the gel has been formed. In this manner uniform distribution of the cross-linking agent throughout the gel is readily achieved.

The resulting shaped gel bodies according to the present invention can be used as optical aids to vision to replace the eye lenses when removed by operation, for instance, to restore vision lost through cataract. Biconvex lenses obtained according to the present invention are implanted immediately after operative removal of the cataractous lens. The lens capsule must remain intact during operation. By selecting a biconvex lens with the required optical characteristics reconstructed according to the present invention, it is thus possible to restore vision to persons afflicted with cataract. Preferably the optical data of the lens to be removed are measured before the operation and the reconstituted lens is selected according to said data from a set of lenses of different characteristics prepared according to the present invention. If at a later time the patient with the implanted lens should become near- or far-sighted, it is readily possible to compensate for such hypo- or hyperfunctioning of the lens by operatively exchanging the improper lens by an optically correct lens which is implanted into the protein chamber of the eye.

The gel according to the present invention can also be produced in convexconcave shape to be fitted as contact lens to the front of the eyeball. These contact lenses may have different optical characteristics so that they can be kept in stock and can be selected as required in order to correct the respective refractive error.